

Indiana, for example, it is estimated that 20 years will be required to balance the quality growth and cut statewide. Emphasis by public and private educational groups on stand-improvement measures is helping. Even greater progress can be made, especially in getting low-quality growing stock out of present stands, by seeking improved harvesting, utilization, and marketing.

## SUMMARY

To summarize briefly: Many changes are taking place in the forests of this vast midcontinent region; some are strengthening the forest economy, others should be of concern. In the Lake States, the most significant points are the thickening up of forest stands in recent years, the presence of a sizable area of deforested land, the expanding reforestation program, and the stabilized ownership situation. Also of interest are the favorable outlook for aspen in the next two decades, the concern about maintaining conifers, and the expanding supply of oak. Improvement of timber quality is an important need.

In the Central States we find, as we did in the Lake States, increases in timber volume and area planted. Of special concern is fire in the Ozarks, regionwide grazing, and the high percentage of low-quality hardwoods. These are all problems to watch, think about, and act on. Present programs are positive forces tending to shape the future and give reason for optimism.



## MISCELLANEOUS REPORT NO. 32

### FOREST-FIRE CONTROL IN THE LAKE STATES

By J. A. Mitchell, Forester

UNITED STATES DEPARTMENT OF AGRICULTURE  
FOREST SERVICE  
Lake States Forest Experiment Station



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Miscellaneous Report No. 32

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Forest fires are an old story in the Lake States, so old, in fact, that it is easy to forget the tragedy and devastation for which they have been responsible, and their potential menace if not kept under control. Other regions have had their "Great Fires," but none have suffered more often or more severely than the Lake States.

Evidence of fires in prehistoric times has been found in the charred remains of ancient trees buried in bogs and glacial drift and is to be seen in the oak openings of southern Wisconsin. The records left by early explorers and missionaries tell of fires that burned for weeks in dry seasons and covered extensive areas. As early as 1735, a Jesuit priest, traveling from Grand Portage to the Lake of the Woods, reported vast fires raging along the way. Frequent references to forest fires are also to be found in old newspapers and the letters of pioneers. It remained for settlement and commercial forest exploitation following the Civil War, however, to set the stage for the catastrophic fires of the past century.

In 1862, Alpena and several nearby sawmill towns in Lower Michigan were wiped out by a slash fire. In 1864, Kewaunee and Manitowoc counties in Wisconsin and the pineries of the St. Croix, Black, Chippewa, and Wolf rivers were reported to be "a raging sea of flame." Eighteen hundred and seventy-one, however, stands out as one of the worst fire years in history. It was a year of extreme drouth in all the North Central States. Crops failed, streams went dry, and prairie fires raged throughout Illinois, Iowa, Nebraska, and the Dakotas. By fall, the forests of the Lake States were tinder dry and the air was full of smoke from countless clearing and logging fires. On Sunday, October 12, Mrs. O'Leary's cow kicked over the lantern that started the "Great

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1/ Paper presented at the Annual Meeting of the Society of American Foresters in Milwaukee, Wisconsin, on October 27, 1954.

2/ Maintained by the U. S. Department of Agriculture, Forest Service, in cooperation with the University of Minnesota, St. Paul Campus, St. Paul 1, Minnesota.



Chicago Fire," one of the worst in history. On the same day, a forest fire destroyed the town of Peshtigo, Wisconsin, with a loss of 1,500 lives and a million and a quarter acres of timber; in Michigan, fires raged from Lake Michigan to Lake Huron, burning over 2 million acres, destroying numerous towns, hundreds of homesteads, and taking an estimated 200 lives; in Minnesota, a fire starting near Two Harbors ran unchecked to the Canadian border, burning a million or more acres.

Ten years later, in September 1881, the "Thumb Fire" in Lower Michigan ravaged over a million acres, took an estimated 282 lives, destroyed numerous settlements, and left hundreds of families homeless. A fascinating account of this fire is given in a report of Sergeant William O. Baily, of the Signal Service (now the Weather Bureau), who traveled over the burned area and interviewed many of the survivors. He emphasizes the extreme dryness that prevailed, the vast areas of logging slash present, the debris left by the fires of 1871, the prevalence of land clearing fires, and the occurrence of winds of hurricane force, all of which combined to produce the holocaust that resulted.

Just 60 years ago, similar fires occurred in Minnesota and Wisconsin. Hinckley and Phillips were destroyed, a quarter of a million acres burned over and nearly 500 lives were lost. Nineteen hundred and ten, the year of the great Idaho fire, was another bad fire year in the Lake States. More than 4 million acres burned over, and the border towns of Baudette and Spooner, Minnesota, were destroyed, with a loss of 42 lives.

The last great conflagration in the Lake States occurred in 1918 when Moose Lake and Cloquet were wiped out, with the loss of 438 lives and over 2 million acres of forest. There have been many other disastrous fires in the Lake States; the Chisholm and Red Lake fires in Minnesota, the Metz, AuSable, and Big Bay fires in Michigan, and the Marshfield, Comstock, and Moquah fires in Wisconsin, to mention only a few. The examples cited, however, serve to show what can happen in the Lake States without adequate protection.

It is true that large-scale logging, unbroken slash areas, and extensive land clearing are largely things of the past. In their place we have innumerable small woods operations, a vast area of highly inflammable grass and second growth (including nearly 2 million acres of coniferous plantations), and greatly increased risk, or chance of fires being started. While organized protection has prevented any catastrophic fires in the Lake States in recent years, the threat remains, as witness the Maine fires of 1947; for forest land is highly inflammable when dry, and critical conditions are bound to occur from time to time. Constant vigilance and aggressive suppression is the only answer. Great conflagrations are seldom the result of a single start. Almost



invariably, they have been due to the flaring up and burning together, under acute conditions, of numerous uncontrolled fires. The prompt suppression of small fires before they get out of hand has been the secret of successful fire control in the Lake States.

### Development of Protection Effort

Personal responsibility for forest fires was established in the Lake States in 1817 by an Act of the Territorial Assembly, signed by Lewis Cass, Michigan's fourth Territorial Governor. This statute, taken from the laws of Ohio, provided a penalty for the "willful or negligent setting of fires on the property of another or allowing fire to escape." Public responsibility for fire control was recognized in 1838 when Michigan's first legislature made Justices of the Peace, Township Supervisors, and Highway Commissioners responsible for fighting forest fires and authorized them to impress labor for this purpose. In 1873, railroads were made specifically responsible for fires set by their locomotives. Precedent for a closed season on burning was set by Wisconsin in the same year, by a law prohibiting the "burning of woods, prairies, or cranberry bogs between August 1 and November 30." In 1895, Township Supervisors were authorized to prohibit burning in bad seasons except by permit. Similar laws were passed by Michigan in 1897, and by Minnesota in 1919.

State responsibility for forest-fire control was recognized by Wisconsin and Minnesota in 1895 and by Michigan in 1903, by the designation of a State official as Chief Forest Fire Warden. Not until 1904 in Wisconsin, 1907 in Minnesota, and 1911 in Michigan, however, did the States participate actively in forest-fire control. At first, State effort was limited to posting fire warnings and protecting life and property. Later, the protection of State forest lands was undertaken in Wisconsin and Michigan; and, as appropriations increased, all three States expanded their efforts to cover forest land generally. By 1930, the bulk of the area most urgently in need of protection from fire was under organized protection.

The passage of the Weeks Law by Congress in 1911 and the Clark-McNary Act in 1923, providing financial assistance to the States for forest-fire control, did much to stimulate interest in forest protection and to promote the development of State protection organizations. The establishment of national forests in the Lake States, about this time, also contributed to the development of protection effort; and the Conservation Corps and Emergency Work Programs of the depression years made effective protection possible by providing, for the first time, the manpower, protection improvements, and heavy equipment needed for effective fire suppression.



## Present Status of Protection Effort

Forest-fire control has come a long way in the last 50 years. At the turn of the century, it was little more than an ideal advocated by a few far-sighted individuals, but considered visionary and impractical by lumbermen and the public at large. Today it is a reality, thanks to the persistent urging of conservation-minded men and women and the organized efforts of State and Federal protection agencies.

In the Lake States, once the classic example of forest devastation, the average number of fires occurring annually has been reduced from around 10,000 to less than 4,000, and the mean annual burn from over a million acres to less than 100,000; all this in spite of greatly increased risk, or the chance of fires being started (figs. 1 and 2).

Approximately 75 million acres, or 61 percent of the land area in the Lake States, may be classified as wild land subject to fire. If counties with less than one-third of their area undeveloped are eliminated, as not in need of organized protection, the net area in need of protection amounts to about 68 million acres, of which Michigan and Minnesota each have 24 million and Wisconsin 20 million. On this basis, Michigan is today 100 percent organized, Minnesota 90 percent, and Wisconsin 65 percent. In all three States, however, the more critical areas are fully covered (fig. 3).

Fire control in the Lake States is primarily the responsibility of the States, since only about 12 percent of the area in need of protection is federally owned. In practice, the Forest Service protects the national forests, the Office of Indian Affairs most of the Indian reservations, the National Park Service Isle Royale, while the State Conservation Departments, with the help of Clark-McNary funds, protect the State and private lands remaining.

All three States recognize fire control as a major activity and maintain more or less independent fire-control divisions or units. In Minnesota and Wisconsin, fire control is coordinated with forestry work under a State Forester; while in Michigan, it is combined with game law enforcement under a Chief of Field Division. Although theoretically sound, the combination of fire control with other activities is satisfactory only if fire control is given top priority; for to be effective, it calls for prompt and vigorous action whenever and wherever fires occur.



# AREA BURNED Lake States

Area Burned - Acres

2,000,000

1,500,000

1,000,000

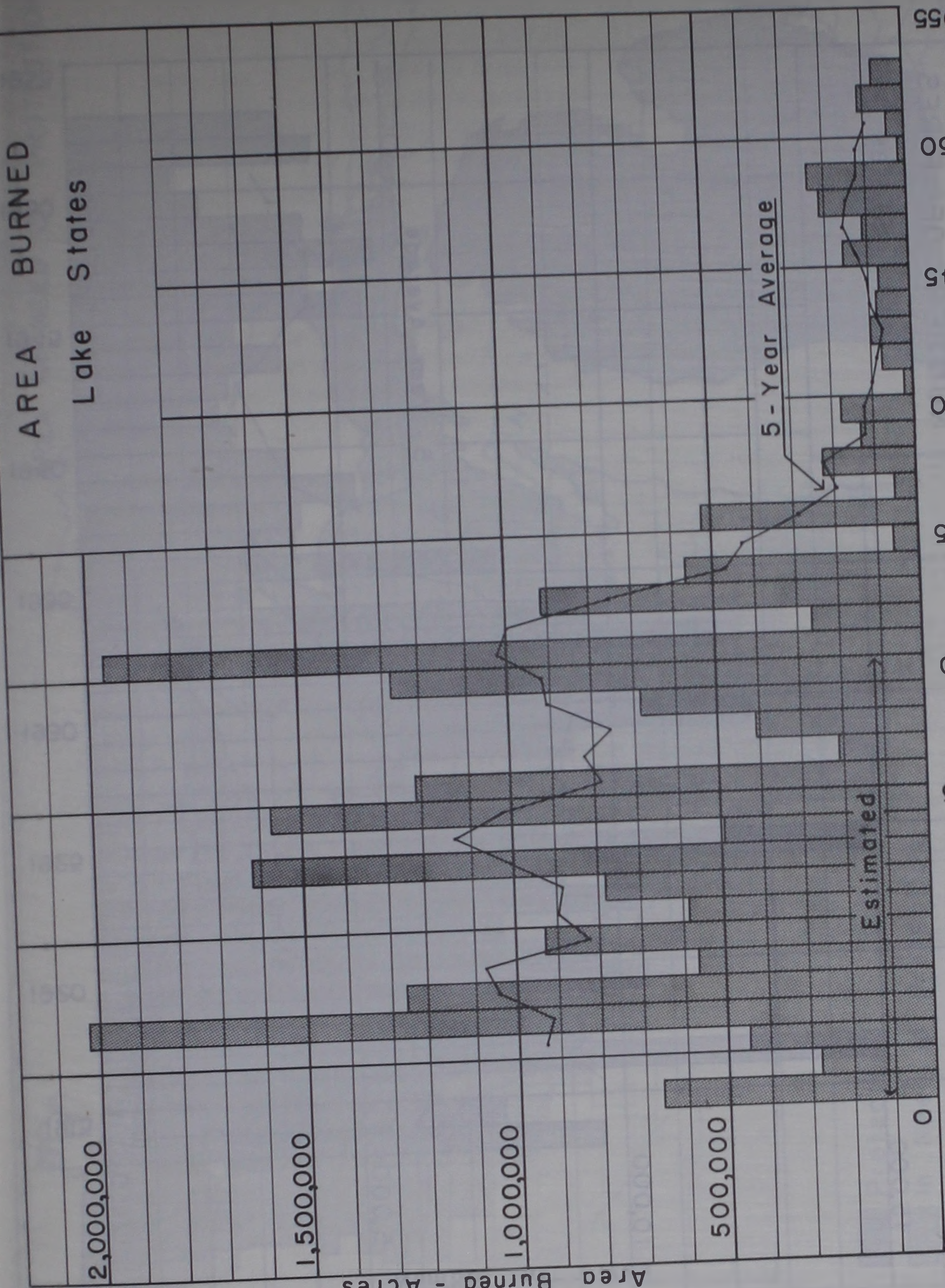
500,000

0

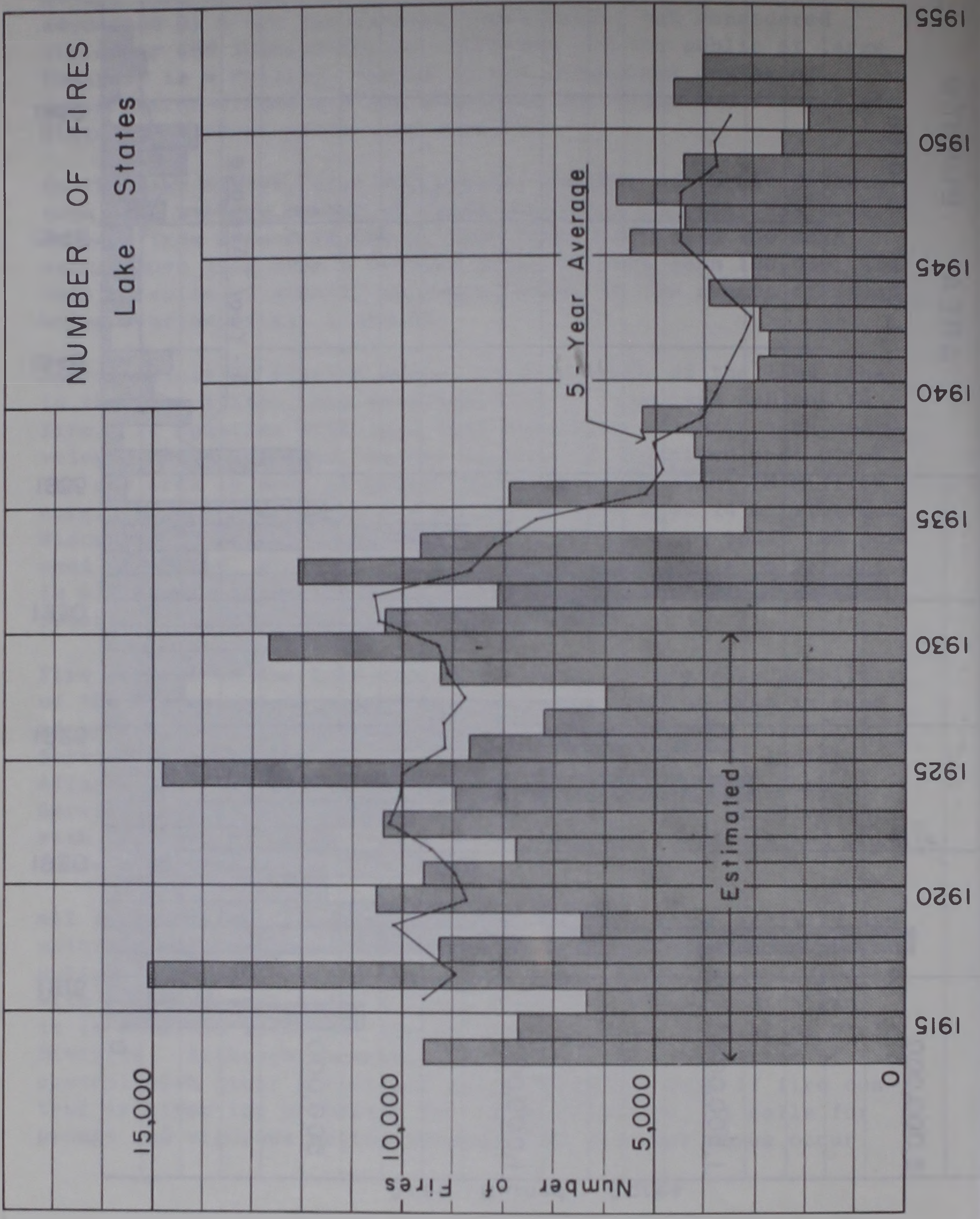
Estimated

5 - Year Average

1915 1920 1925 1930 1935 1940 1945 1950 1955

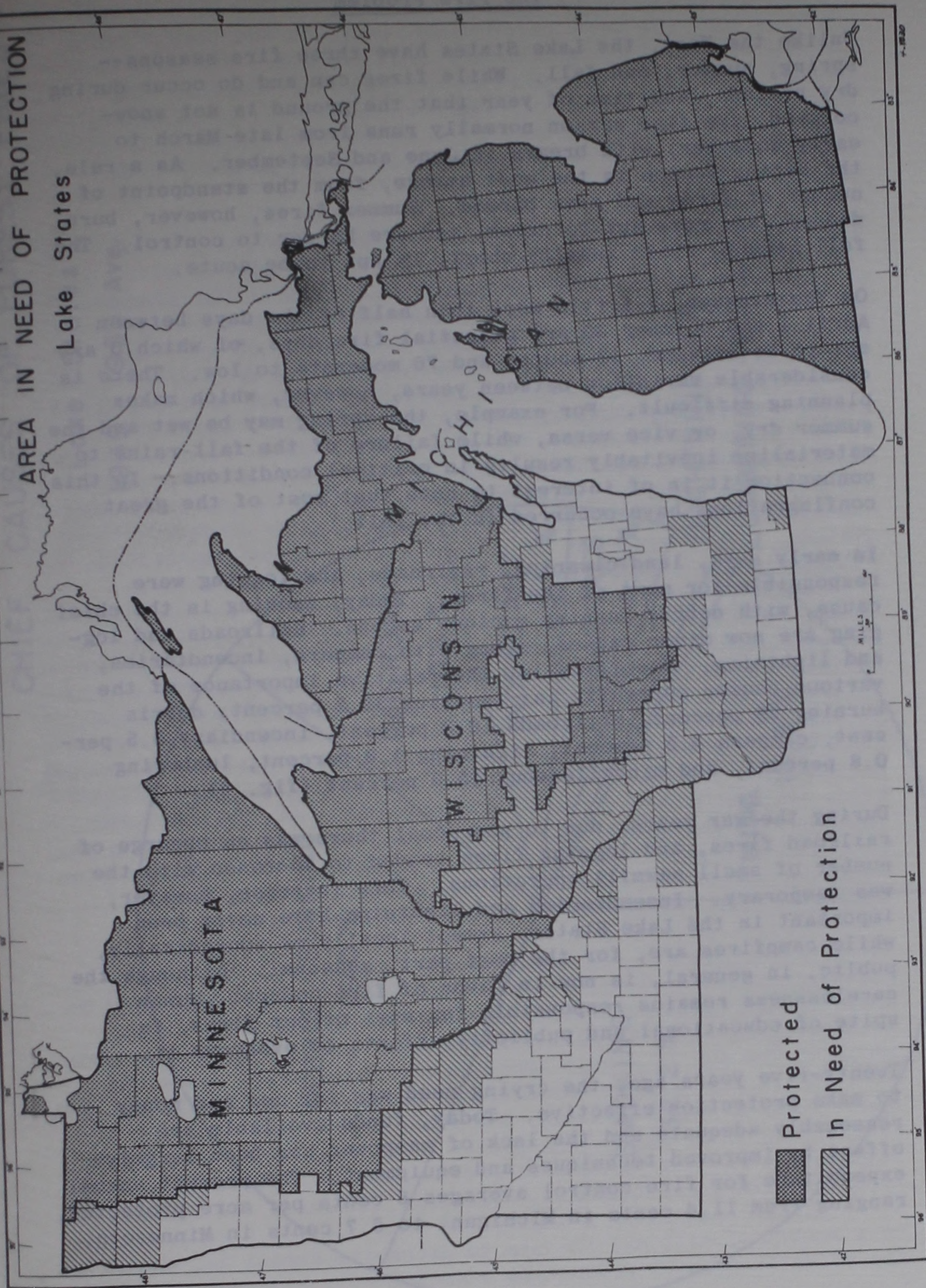








AREA IN NEED OF PROTECTION  
Lake States





## The Fire Problem

Unlike the West, the Lake States have three fire seasons--spring, summer, and fall. While fires can and do occur during dry periods, any time of year that the ground is not snow-covered, the fire season normally runs from late March to early November, with breaks in June and September. As a rule, the spring season is the most severe, from the standpoint of number of fires and area burned. Summer fires, however, burn deeper, are more apt to crown, and are harder to control. The fall season, while usually short, is apt to be acute.

On the average, a little more than half of the days between April 1 and October 30 are potential fire days, of which 5 are apt to be extreme, 43 acute, and 76 moderate to low. There is considerable variation between years, however, which makes planning difficult. For example, the spring may be wet and the summer dry, or vice versa, while failure of the fall rains to materialize inevitably results in critical conditions. In this connection it is of interest to note that most of the great conflagrations have occurred in the fall.

In early days, land clearing, railroads, and logging were responsible for most of the fires. Today, smoking is the chief cause, with debris burning a close second. Railroads and logging are now minor causes, along with campers, incendiaries, and lightning. Specifically, the relative importance of the various causes currently is: smoking 32.2 percent, debris burning 29 percent, railroads 10.3 percent, incendiary 5.5 percent, campers 4.5 percent, lightning 1.8 percent, lumbering 0.8 percent, and miscellaneous 15.9 percent (fig. 4).

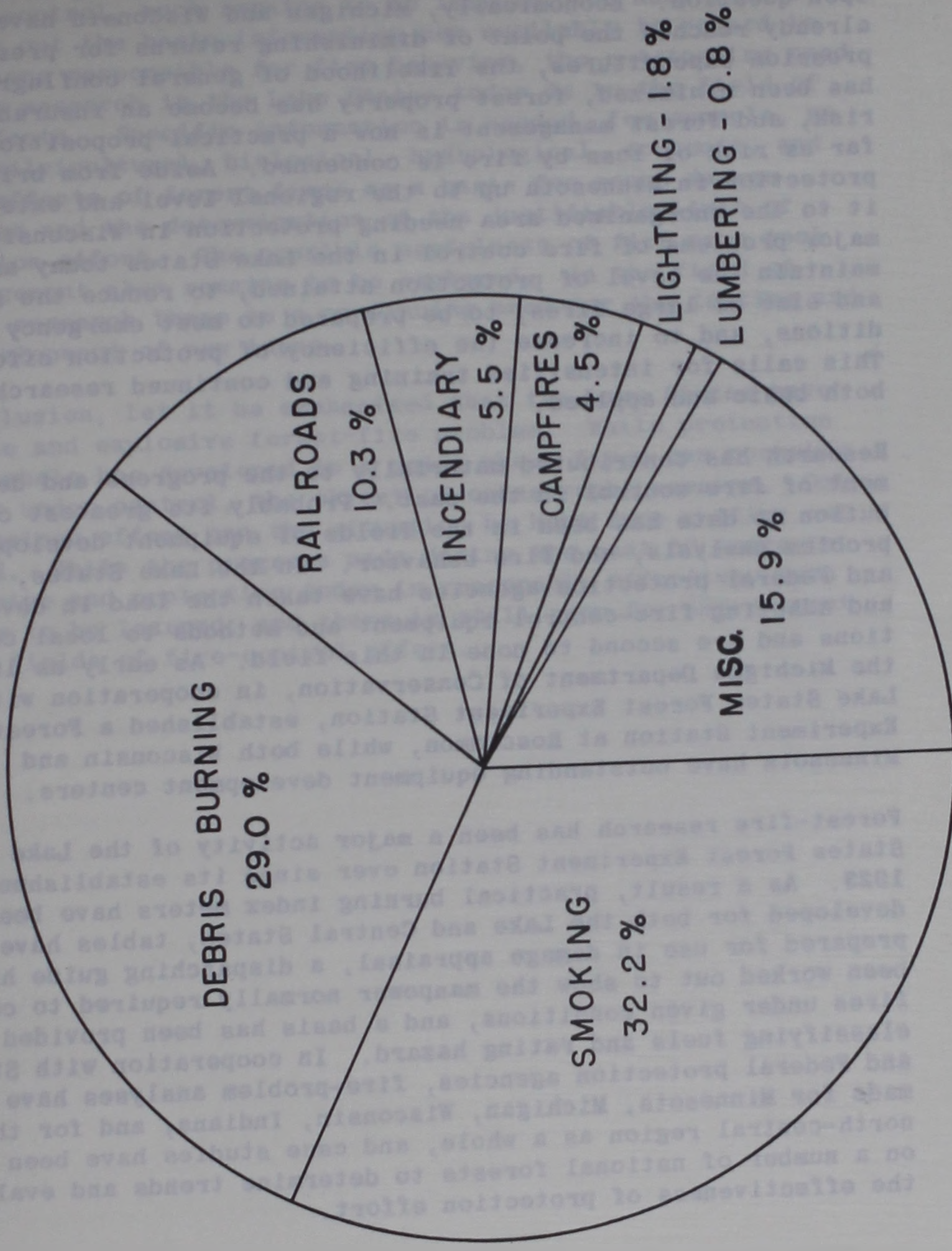
During the war years, due to poor coal there was an upsurge of railroad fires, and logging fires tended to increase with the number of small sawmill operations. This increase, however, was temporary. Incendiarism and lightning have never been important in the Lake States, except locally or sporadically, while campfires are, for the most part, seasonal. Although the public, in general, is now in favor of fire control, human carelessness remains responsible for most of our fires, in spite of educational and publicity efforts to overcome it.

Twenty-five years ago, the crying need was for men and money to make protection effective. Today, funds available are reasonably adequate and the lack of manpower has been largely offset by improved techniques and equipment. The present annual expenditure for fire control averages 8 cents per acre protected, ranging from 11.4 cents in Michigan, to 5.7 cents in Minnesota.



# CHIEF CAUSES OF FOREST FIRES

Lake States  
1949 - 1953 Ave.





The effectiveness of the protection afforded may be judged by the fact that the mean annual burn, based on the last 5 years, is only 0.16 of 1 percent of the area protected and that less than 18 percent of the fires exceed 10 acres in size. While there is still room for improvement, especially in Minnesota, which has a mean annual burn of 0.36 percent, protection in the Lake States as a whole may be considered adequate under normal conditions.

How much further public effort is justified in going is an open question. Economically, Michigan and Wisconsin have already reached the point of diminishing returns for suppression expenditures, the likelihood of general conflagrations has been minimized, forest property has become an insurable risk, and forest management is now a practical proposition, as far as risk of loss by fire is concerned. Aside from bringing protection in Minnesota up to the regional level and extending it to the unorganized area needing protection in Wisconsin, the major problems of fire control in the Lake States today are to maintain the level of protection attained, to reduce the number and size of large fires, to be prepared to meet emergency conditions, and to increase the efficiency of protection effort. This calls for intensified training and continued research, both basic and applied.

Research has contributed materially to the progress and development of fire control in the past. Probably its greatest contribution to date has been in the fields of equipment development, problem analysis, and fire behavior. In the Lake States, State and Federal protection agencies have taken the lead in developing and adapting fire-control equipment and methods to local conditions and are second to none in this field. As early as 1930 the Michigan Department of Conservation, in cooperation with the Lake States Forest Experiment Station, established a Forest Fire Experiment Station at Roscommon, while both Wisconsin and Minnesota have outstanding equipment development centers.

Forest-fire research has been a major activity of the Lake States Forest Experiment Station ever since its establishment in 1923. As a result, practical burning index meters have been developed for both the Lake and Central States, tables have been prepared for use in damage appraisal, a dispatching guide has been worked out to show the manpower normally required to control fires under given conditions, and a basis has been provided for classifying fuels and rating hazard. In cooperation with State and Federal protection agencies, fire-problem analyses have been made for Minnesota, Michigan, Wisconsin, Indiana, and for the north-central region as a whole, and case studies have been made on a number of national forests to determine trends and evaluate the effectiveness of protection effort.



DOCUMENT BREAK

The Station was also instrumental in establishing the present network of State and Federal fire-weather stations and for some years was responsible for their inspection and for the training of observers, a job now handled by the Chicago office of the Weather Bureau. Also, notable progress has been made by the Weather Bureau in fire-weather forecasting, in keeping protection agencies informed as to impending conditions, and in making spot forecasts for critical areas.

While definite progress has been made in solving the problems of fire control, much remains to be learned. In addition to rounding out the basic information now available in regard to the factors responsible for fire behavior, the outstanding need for fire research in the Lake States today is in the field of fire effects. Specific information is needed, for example, as to the silvicultural, biological, hydrological, economic, and social effects of forest fires as a basis for sound damage estimates and the determination of the justifiable limit of protection effort. The possible usefulness of fire as a tool in management also remains to be explored. In the field of applied research there is a continuing need for the testing and the development of new ideas.

In conclusion, let it be emphasized that the Lake States have an acute and explosive forest-fire problem. While protection on the whole has developed to a point where fires can normally be kept under control, the threat of catastrophe remains. Only by sustained effort can the situation be kept from getting out of hand. While the progress made during the past 50 years is impressive and protection today is reasonably effective, much remains to be learned; and there is still room for improvement in all fields of fire-control effort.